

## Summary of Data

Water quality sampling occurred at six sites within the Lake Glenville watershed on 12/17/24. All sites were located as close as possible to sites sampled in previous monitoring years; the location for the Glenville Creek sample was again sampled downstream at its standard location. A very light rain had occurred in the early morning prior to sampling on 12/17/24, the area received 0.43 inches of rain on 12/15/24, 0.04 inches on 12/16, and 0.08 inches on 12/17. the preceding days from 05/18/24 – 05/19/24 (Figure 1). Stream flows were elevated compared to normal base flow, but not flood levels. The suite of parameters sampled included water temperature, dissolved oxygen (DO), pH, specific conductivity, turbidity, fecal coliform, ammonia, nitrite/nitrate, phosphate, and alkalinity.

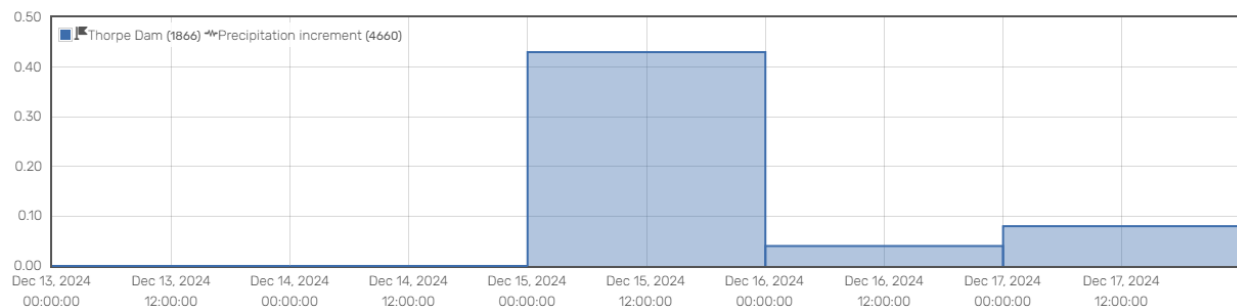


Figure 1. Precipitation for the week of sampling.

**Turbidity was less than 1 NTU for all sites.** The state standard for North Carolina streams that carry the Trout Waters (Tr) designation is that turbidity shall not exceed 10 NTU. Pine Creek, Mill Creek, Norton Creek, Hurricane Creek, and Cedar Creek all carry the Tr classification. Glenville Creek is too small to be classified under this system. The regional Volunteer Water Information Network (VWIN) mean is 11.4 NTU.

Dissolved oxygen is the amount of oxygen dissolved in water. The concentration of dissolved oxygen in surface water is affected by temperature and has both a seasonal and a daily cycle. Cold water can hold more dissolved oxygen than warm water. In winter and early spring, when the water temperature is low, the dissolved oxygen concentration is high. In summer and fall, when the water temperature is high, the dissolved oxygen concentration is often lower. Dissolved oxygen is important for ecological health as most aquatic organisms need oxygen to survive and grow. Some species, such as trout and stoneflies, require high DO levels (>6 mg/L) for survival, and trout show improved reproductive health when DO levels are above 10 mg/L. **Dissolved oxygen concentrations for the sampling event ranged between 14.0 mg/L in Norton Creek and 16.1 mg/L in Cedar Creek.**

An increase in observed acidity was a concern over the course of a few samplings in both the tributaries to Lake Glenville and the lake itself. However, during the most recent tributary samplings pH values have trended toward the regional VWIN mean (7.1). As has been stated

previously, acidic waters are not uncommon for high elevation streams in the area. Depths to bedrock are shallow with thin soils and rock types do not have a mineralogy that buffers groundwater as it moves through the ground and reemerges in the streams. However, there are anthropogenic sources which can increase the acidity in streams to levels which are unhealthy for trout (below 5.0). High elevation areas of eastern Tennessee and Western North Carolina receive elevated rates of atmospheric acid deposition in comparison with other areas on the east coast, resulting in increased episodic stream acidification events, adding to the acidification of soil and surface waters. Episodic stream acidification occurs when heavy rain downpours bring increased acidic deposition to soils and water bodies, resulting in periods of increased stream flow and decreased water pH.

The issue of acidity is complicated by the fact that rain is, on average, much more acidic in the summer than in the winter. Continued monitoring of acidity will help increase awareness of any potential problems. It is important to note that although the effects of the issue are felt locally, it originates at a regional, continental scale and is not a “stand-alone” problem. It relates intimately to energy, land use, urban, transport, and other socioeconomic issues.

**On 12/17/24 pH values ranged from 6.0 to 6.7, values that are an improvement and more in line with what we would want to see when compared to some of the numbers from 2021 and 2022.**

Ammonia concentrations were low and more in line with those previously observed at all the sampled locations. **Ammonia values ranged from 0.04 mg/L to 0.09 mg/L.** All streams were either under or equal to the Regional VWIN mean of 0.09 mg/L. Ammonia is produced by bacterial decomposition of organic matter that accumulates in stream sediment; therefore, we would expect to see higher ammonia values following rainfall events where those sediments are being mobilized and transported.

**Nitrite/Nitrate-Nitrogen concentrations were very low, ranging between 0.1 mg/L and 0.2 mg/L,** well below the regional VWIN average of 0.5 mg/L. Phosphorus concentrations were also low and ranged from undetectable to 0.02 mg/L. The regional VWIN average for phosphorus is 0.02 mg/L. Grass fertilizers and livestock are a frequent source of phosphorus. Once in the stream and lake system, rainfall can disturb the sediments, resulting in internal loading of previously deposited phosphorus.

Under state rules, fecal coliform in fresh waters “shall not exceed a geometric mean of 200 colony forming units (CFU)/100 mL based upon at least five consecutive samples examined during any 30-day period, nor exceed 400 CFU/100 mL in more than 20 percent of the samples examined during such period.”. As such, any single sample is difficult to compare to the state standard, but as a rule of thumb low numbers are good and numbers exceeding 200 CFU/100 mL are bad. However, violations of the state standard are expected during heavy rainfall events and may be caused by uncontrollable nonpoint source pollution. Nonpoint source pollution comes from contaminants that end up on the ground naturally or from human activity. Rainwater and snowmelt pick up these contaminants as it washes over yards, sidewalks, driveways, parking

lots, and fields and deposits them into lakes and streams as nonpoint source pollution. Common sources of nonpoint source pollution in the Lake Glenville watershed could include:

- animal production operations and feedlots;
- agricultural activities;
- stream bank and shoreline erosion;
- timber harvesting;
- land development;
- on-site sewage disposal units;
- atmospheric deposition.

**Fecal coliform concentrations ranged from 11 CFU/100 mL in Cedar Creek to 130 CFU/100 mL in Pine Creek. Pine Creek had a concentration of 130 CFU/100mL.**

## Discussion of Hurricane Helene

Between the previous sampling of water quality for Lake Glenville, Western North Carolina was heavily impacted by Hurricane Helene. Here is a brief discussion of some of the impacts.

**Heavy Rainfall and Flooding:** Hurricane Helene brought significant rainfall to the Western North Carolina, causing widespread flooding and damage. The excessive rain led to concerns about the structural integrity of dams in the area. Thorpe Dam, like others in the region, experienced increased water levels due to the heavy rainfall, however, there have been no reports of significant damage to the dam. Similarly, Lake Glenville saw a surge in water levels due to the heavy rainfall. From the Friends of Lake Glenville Facebook page here is a description of those rising waters withing the lake:

“Between 10 pm on Thursday 9/26 and 6 am Friday 9/27, the lake rose an astonishing 7 feet and continued to rise another 3 feet throughout the day on Friday. The water turned the color of the muddy Mississippi and took about 5 days for somewhat normal clarity to return.”.

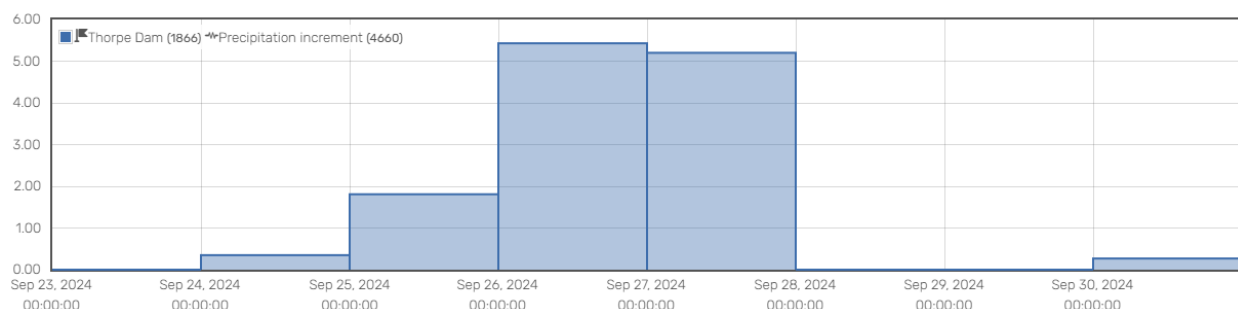


Figure 2. Precipitation for the week of Hurricane Helene.

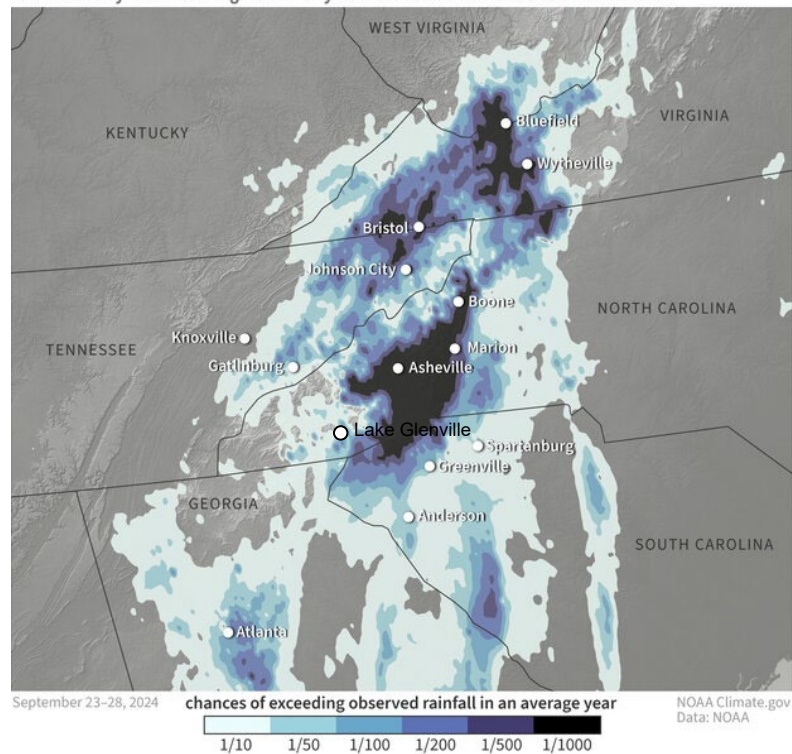
Despite the enormous amount of rain and increased discharge, Lake Glenville was spared the heaviest amounts and impacts from the event. Below is a map of the rainfall amounts from Hurricane Helene in terms of statistical probability for exceedance.



# EQUINOX

balance through proper planning

How unlikely were the highest 3-day rainfall totals associated with Helene?

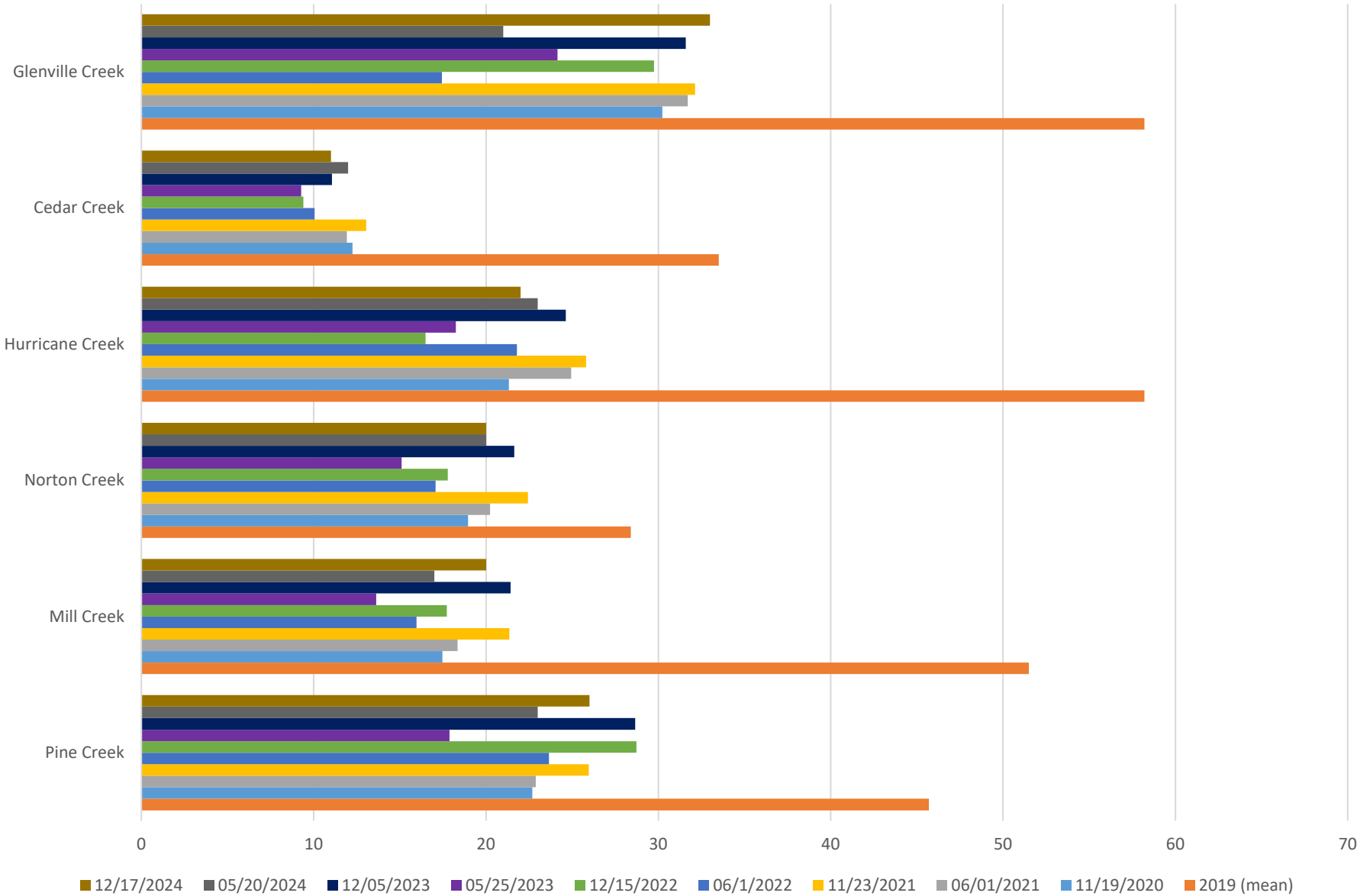


Between September 23 and 28, the highest 3-day rainfall totals across the higher elevations of the southern Appalachian Mountains were so extreme that the statistical chances of them being exceeded in any given year were 1 in 1,000 (black areas). Statistically, this is the same as saying that averaged over long periods of time, a 3-day rainfall event so extreme would only occur on average (not literally!) once every 1,000 years. NOAA Climate.gov graphic, adapted from original by NOAA's [National Weather Service](https://www.noaa.gov/media/2024/09/24/helene-rainfall-odds).

Overall, the quality of the water in the tributaries to Lake Glenville seems to have returned to the baseline, pre-storm conditions and is best described as high-quality waters. There is a lot of large woody debris that accumulated within the channels during the storm, but it's important to remember that woody debris is a normal, natural component of streams in our area, and is in fact, important to their health.

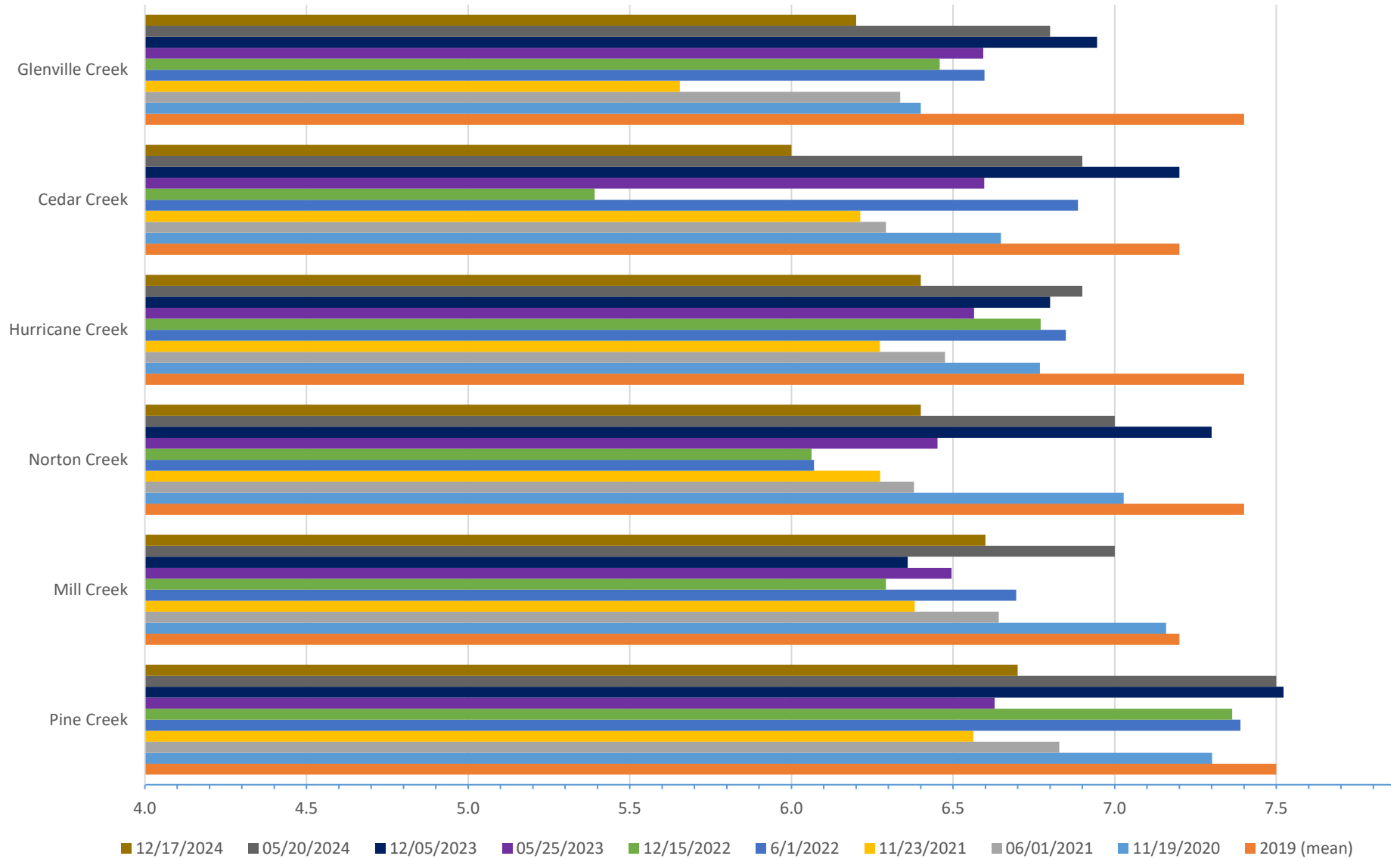
## Specific Conductivity ( $\mu\text{S}/\text{cm}$ )

Regional VWIN mean 60 ( $\mu\text{S}/\text{cm}$ )- (used to compare results against typical regional values )



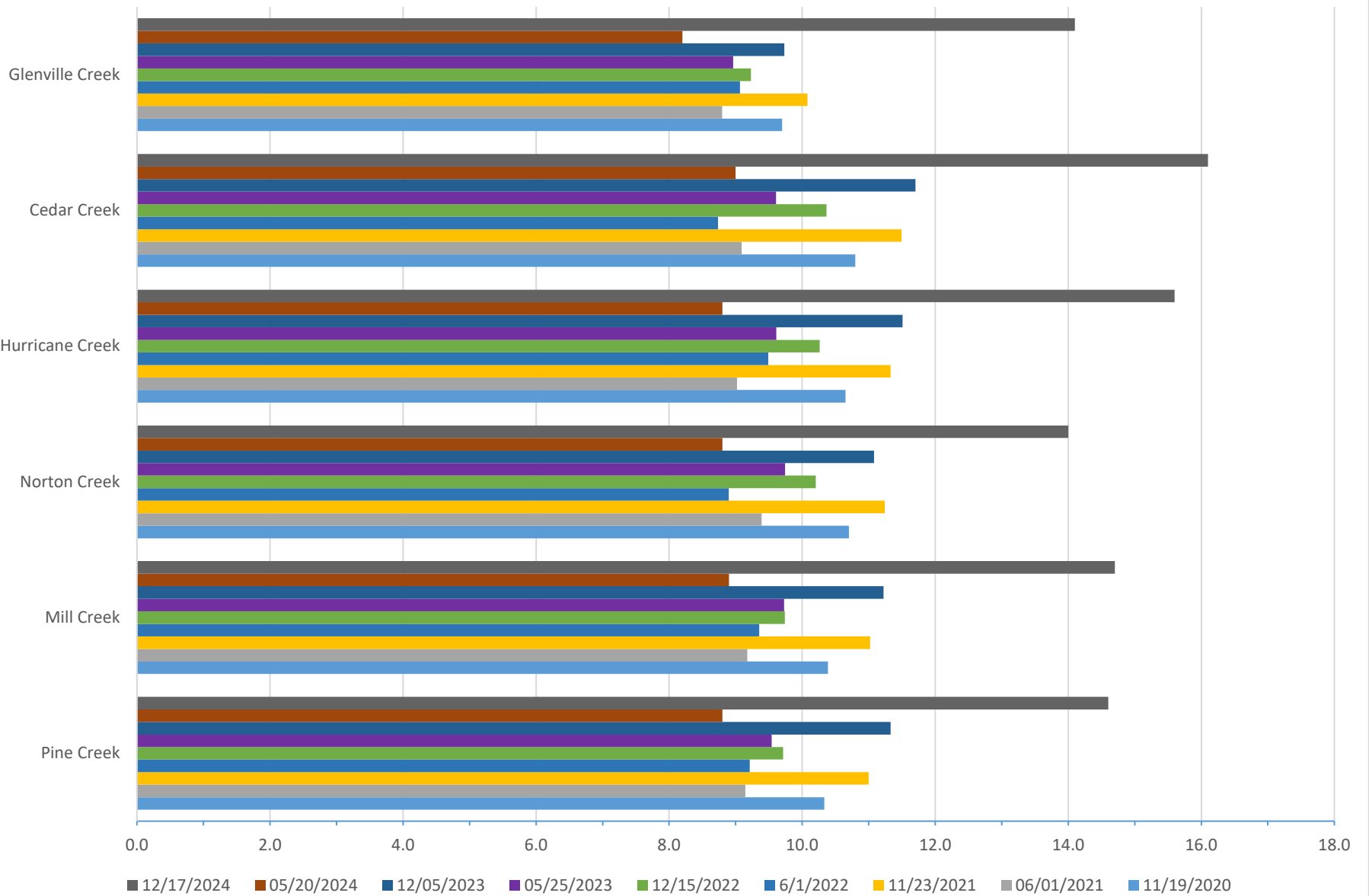
# pH

Regional VWIN mean pH 7.1 - (used to compare results against typical regional values )



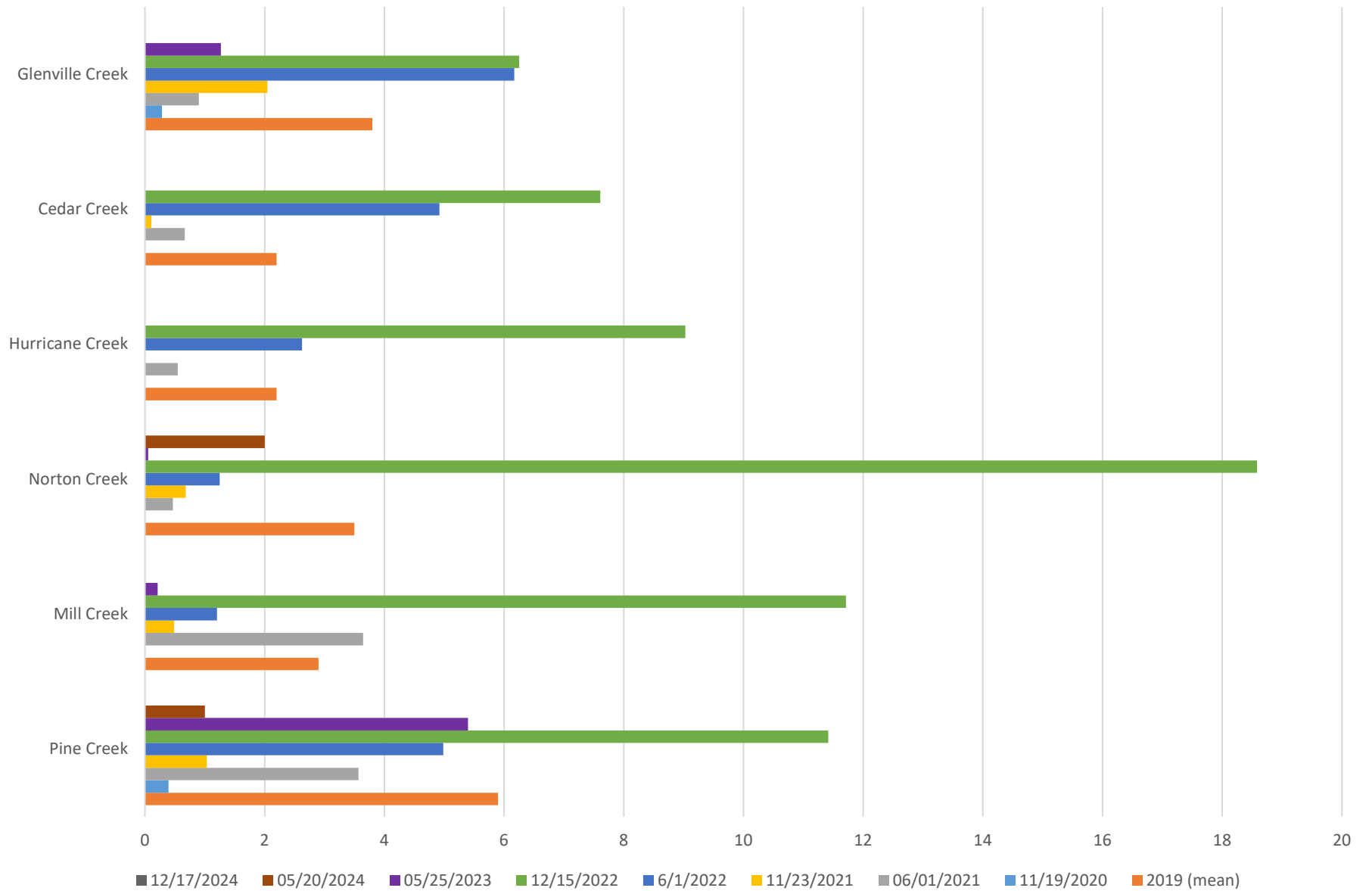
# Dissolved Oxygen (mg/L)

NC Trout Water designation standard  $\geq 6$  mg/L



## Turbidity (NTU)

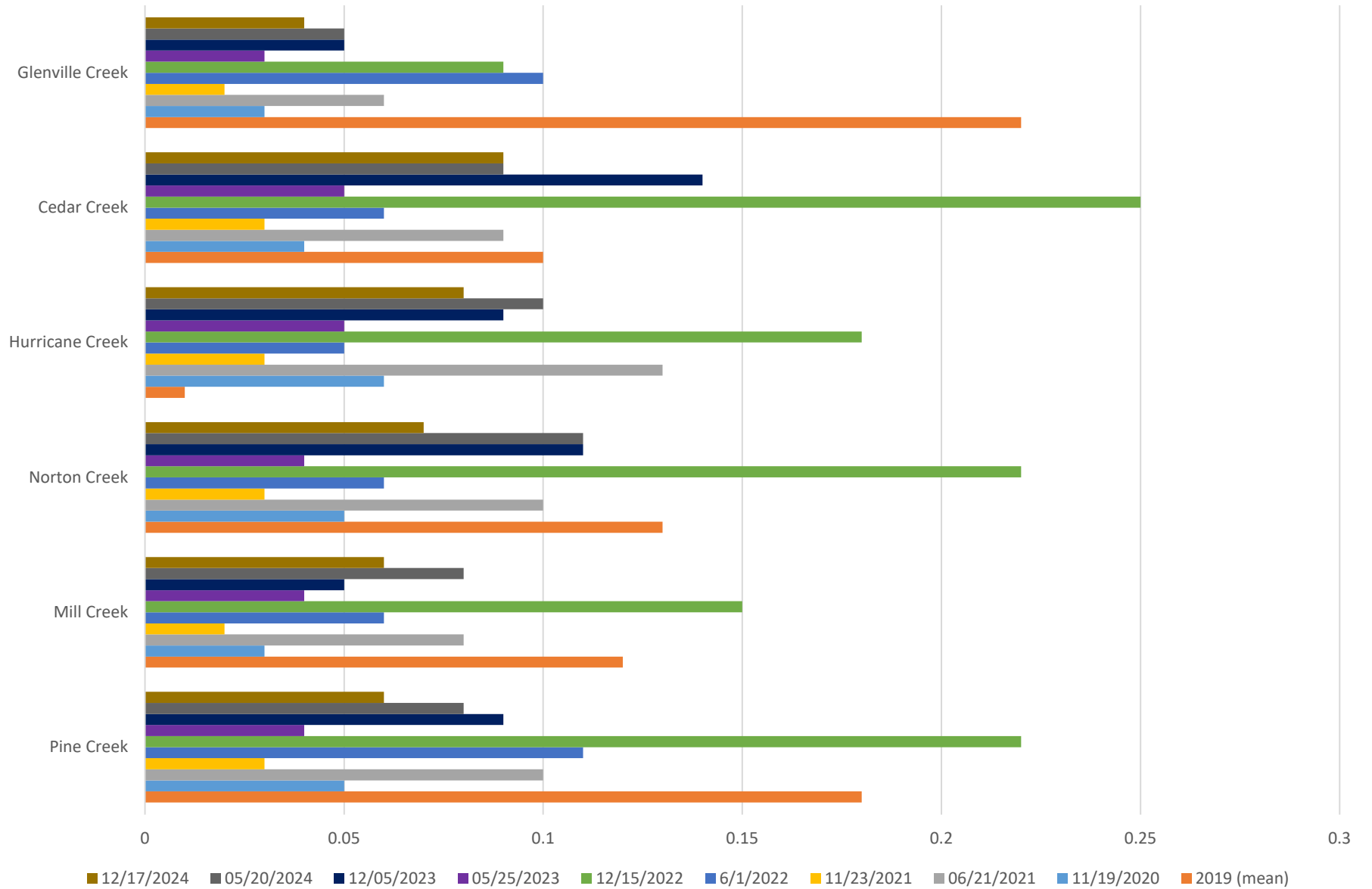
Regional VWIN mean 6.2 NTU - (used to compare results against typical regional values )





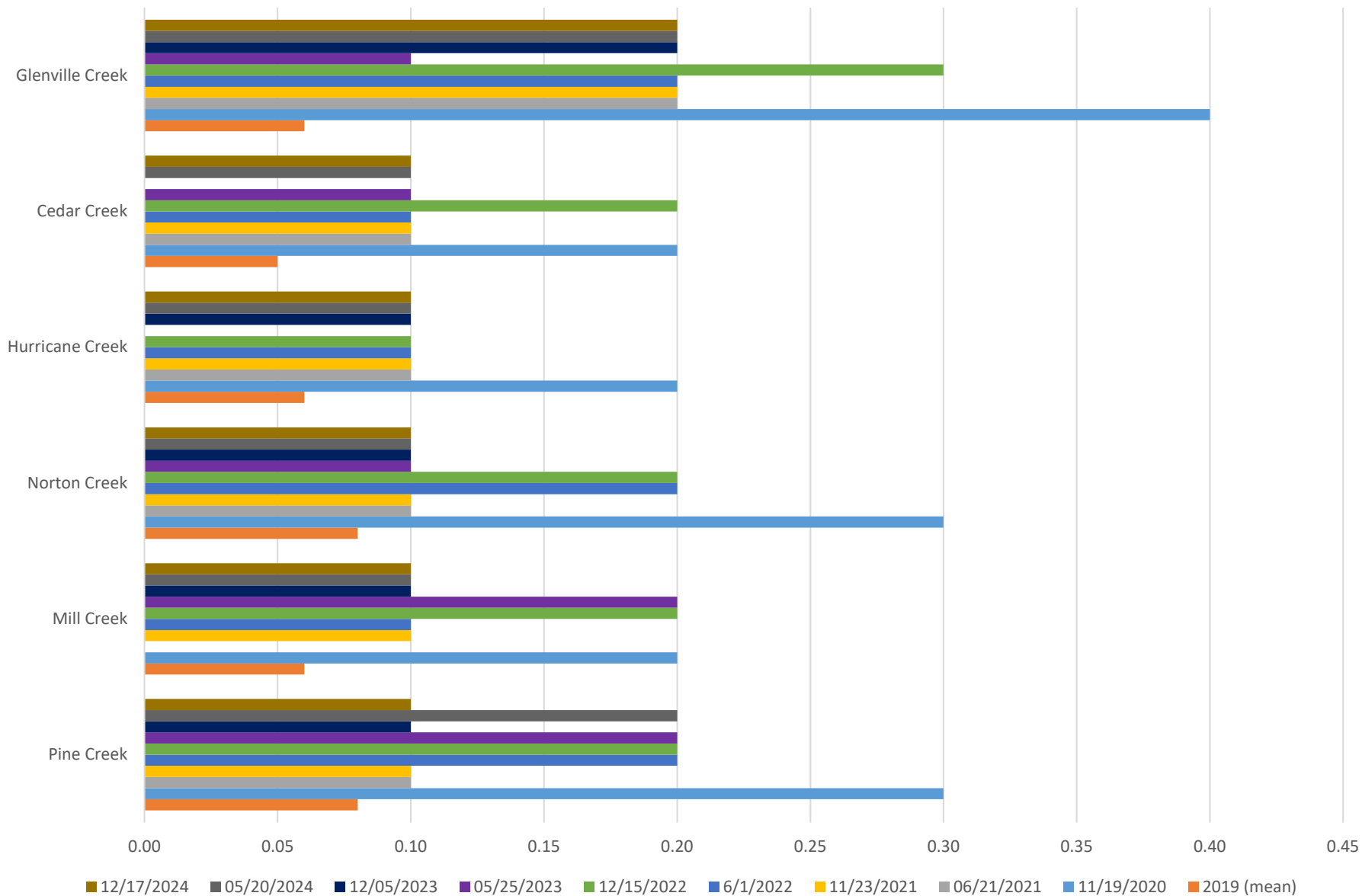
## Ammonia (mg/L)

Regional VWIN mean 0.09 mg/L - (used to compare results against typical regional values )



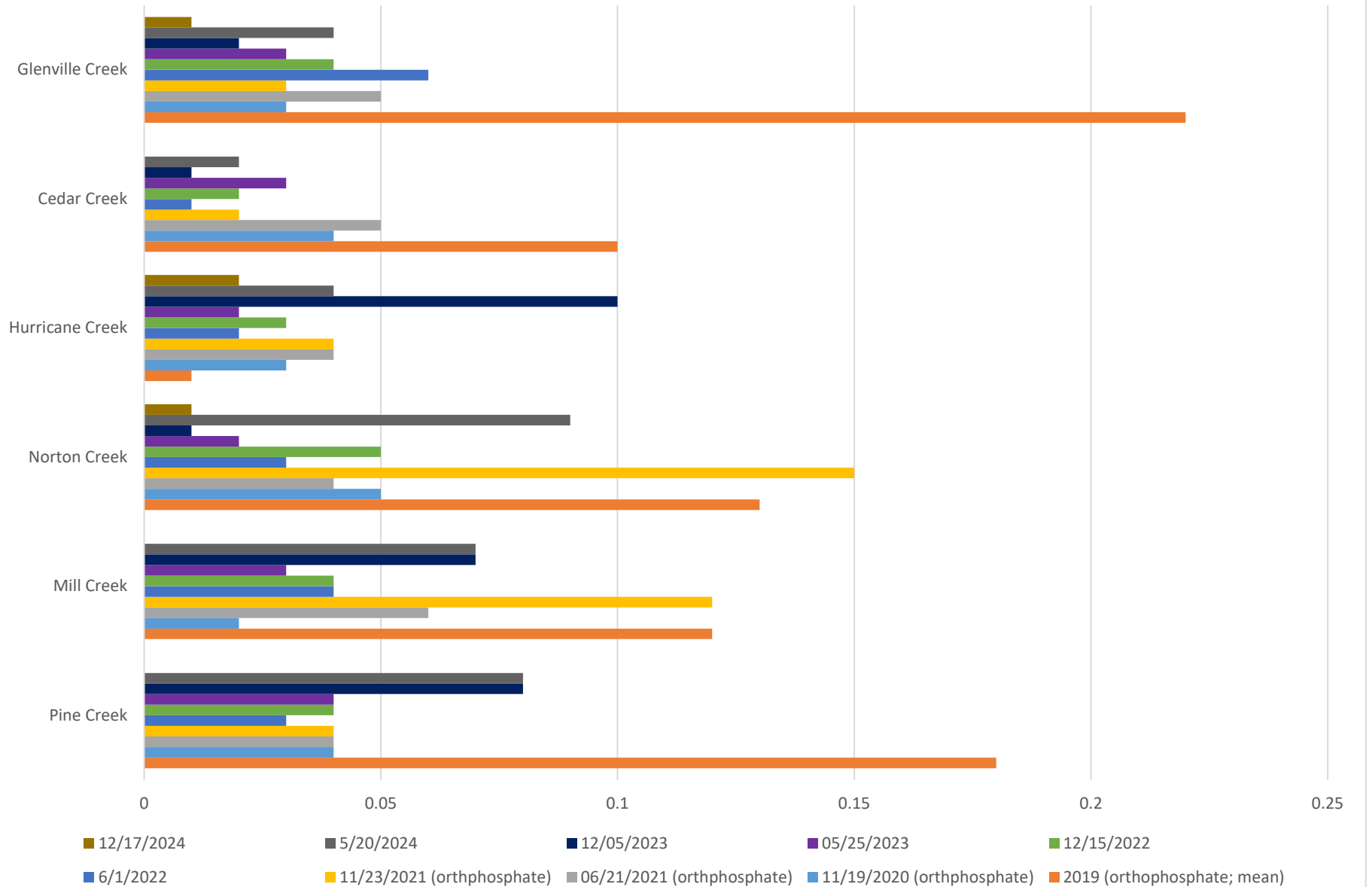
## Nitrite/Nitrate-Nitrogen (mg/L)

Regional VWIN mean 0.5 mg/L - (used to compare results against typical regional values )

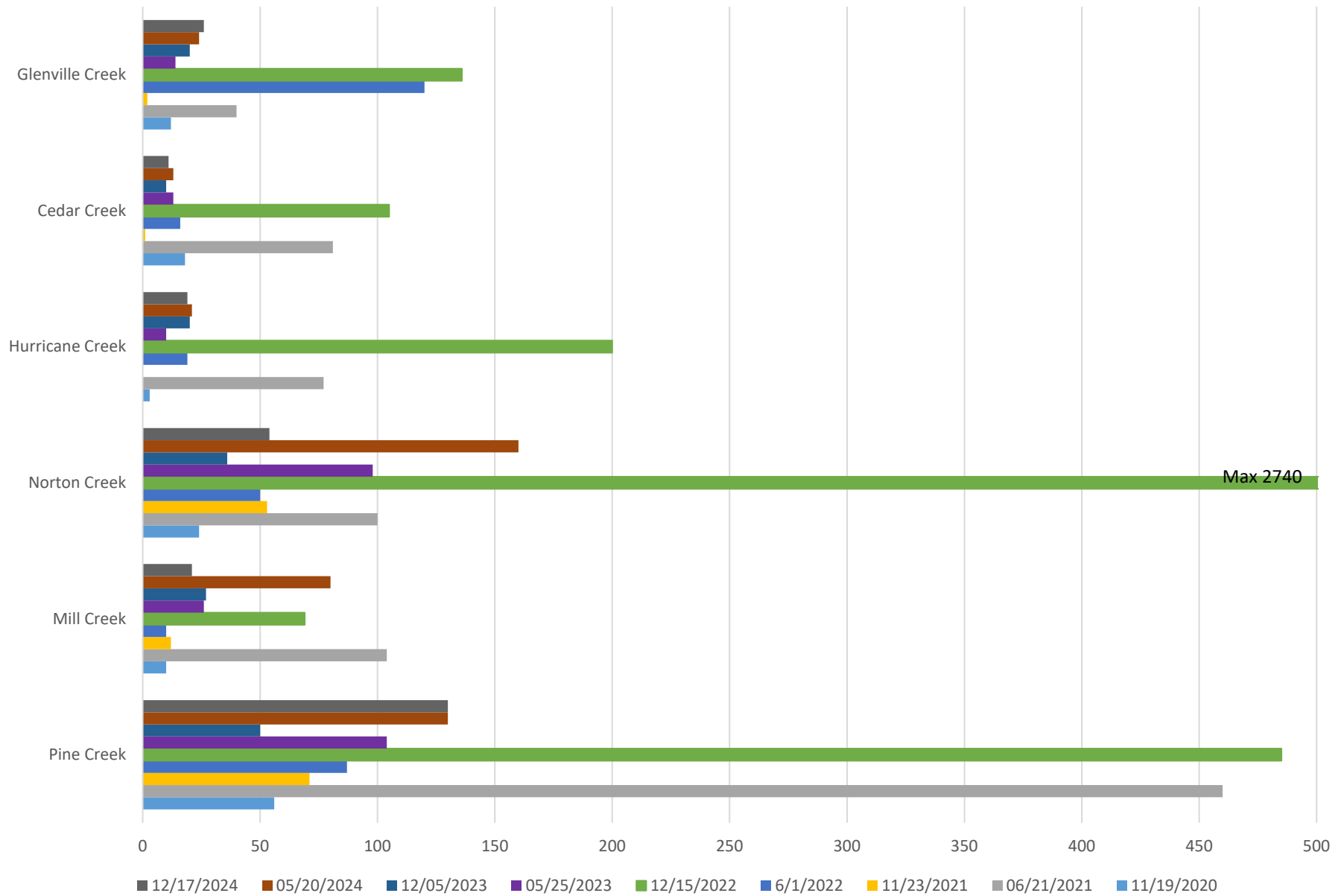


# Phosphorus (mg/L)

Regional VWIN mean 0.09mg/L - (used to compare results against typical regional values )

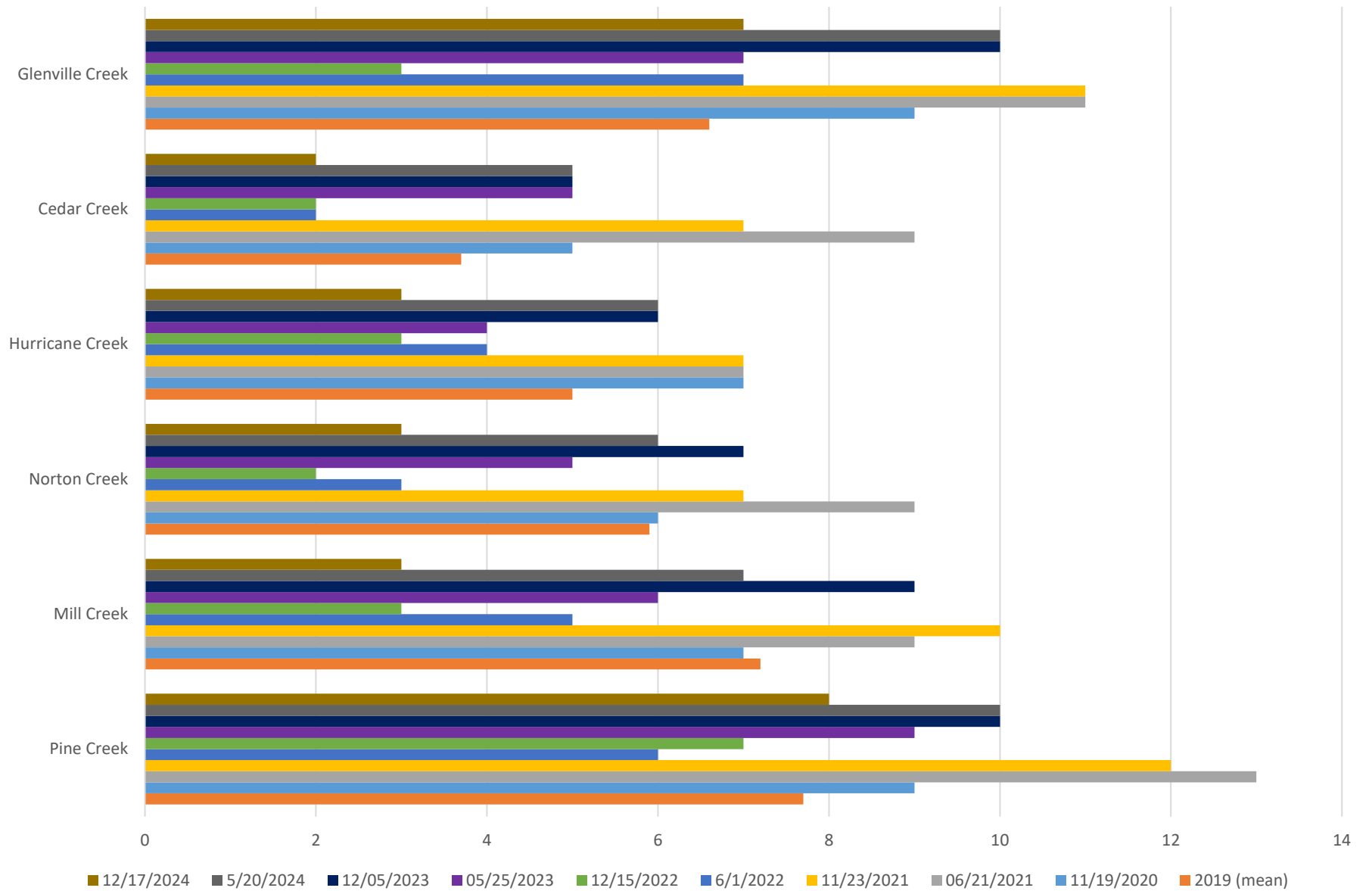


## Fecal Coliform (CFU/100 mL)



## Alkalinity (mg/L as CaCO<sub>3</sub>)

Regional VWIN mean 22.3 mg/L - (used to compare results against typical regional values )



# Temperature (°C)

